Envisioning Distributed Usability Evaluation through a Virtual World Platform

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***Abstract*—Ideally, usability evaluation would be part of every software development project. However, it is often overlooked due to cost and time constraints. Usability inspection methods were developed to cut cost and time compared to traditional usability evaluation. However, they still bring with them certain requirements such as having multiple designers involved in the evaluation. Inspection techniques have also been shown to be difficult to learn and teach. With software development projects becoming increasingly distributed, it is ever more difficult to have sufficient participants in a usability inspection and to collaboratively learn the techniques. Motivated by these problems, we developed a novel, prototype environment called INspect-World for distributed usability inspection techniques. INspect-World is built on top of the virtual world platform OpenSimulator. As we investigate usability inspections performed in this environment, we also address ideas of human-centered end-user development in mediated communication contexts.**

***Keywords*-Distributed usability analysis; usability inspection techniques; virtual worlds; distributed teams; computer-supported cooperative work; human-computer interaction; software engineering.**

I. Introduction

We seek to investigate how virtual world environments can enable distributed usability inspection techniques and to develop a virtual environment for conducting distributed usability inspections in the fields of software engineering and human-computer interaction (HCI).

There is a real need for technological environments that support distributed teams, as distributed team settings have become common in many business areas [1]. Software development especially is increasingly conducted in a distributed environment [2] and usability evaluation is a key aspect of software development [3]. Traditionally designed for face-to-face settings, current usability inspection techniques are difficult to adopt by distributed teams. Also, learning usability inspection methods is often still very difficult and time-consuming for novice practitioners and preparing for complex inspection procedures can represent considerable barriers for adopting usability inspection techniques [4].

Building upon the open-source virtual world platform OpenSimulator (http://www.opensimulator.org), we developed a novel, prototypical virtual environment for distributed usability inspections that specifically addresses the difficulties faced by practitioners in distributed teams. The initial prototype environment called *INspect-World* implements the cognitive walkthrough (CW) inspection technique for distributed teams. The CW enables usability experts to locate usability problems in a user interface based on screen shots, mockups or live systems [5]. Evaluators first describe a typical user, choose tasks to be evaluated and formulate detailed action sequences necessary to complete the tasks. Next, evaluators go through the action sequences individually, asking questions about action effects, availability, associations, and progress towards task completion.

Continued iterative development and evaluation of *INspect-World* provide us with a test bed for exploring various usability inspection techniques and human-centered end-user development themes in distributed software engineering settings.

II. Prototype Scenario

INspect-World supports the CW technique. The CW represents a robust inspection technique used in software engineering. However, practitioners encounter several difficulties with the CW technique. Novice users, who are not experts in usability evaluations, often encounter a steep learning curve [4]. Users can easily lose track of the complex inspection process. Preparing for the inspection of a complex interface can be a very time-consuming task. To achieve comprehensive results, a number of experts need to complete the inspection process. Yet convening large numbers of developers in one physical location is increasingly difficult and costly for globally distributed development teams.

Figure 1. *INspect-World*'s organization space

INspect-World implements two main areas in the virtual world: an organization space and a walkthrough arena, both

shown in Figure 1 and Figure 2 respectively. The organization space serves as a meeting and planning environment for setting up the CW procedure. A virtual video screen (Figure 1, left) displays live video streams in the virtual world. The screen can be used to communicate with individuals who can only participate using their mobile devices. The object browser (Figure 1, center) serves as a database interface to manage objects evaluated during the CW. Users can access screenshots associated with specific actions of an action sequence and notes taken during previous inspection sessions. A management screen (Figure 1, right) functions as a multi-purpose browser interface for managing the availability of participants and scheduling evaluation sessions.

Figure 2. *INspect-World*'s usability inspection arena

Following the planning phase, the CW is conducted in the inspection arena (Figure 2). Individual actions are arranged on separate screens in the inspection arena. Participants move freely between the screens to go through the evaluation process. At each action step, evaluation results are recorded by the participants on the input screens located next to the action screens. NPCs (non-player characters, i.e. scripted avatars controlled by system) provide support during the evaluation process. NPCs remind users of uncompleted steps and can answer questions regarding the walkthrough technique. Participants evaluate the interface at each step using voice and text chat. Positioning the avatar and pointing to specific sections creates awareness of the team member's actions. Contextual information, such as each avatar's location and activities, is saved automatically. *INspect-World* ensures that the criteria of the inspection technique are followed and that the any progress is saved in the project database.

III. Related Research and Preliminary Works

There have been attempts to automate aspects of the evaluation process [6] and methods have been changed to fit specific application areas [7]. In another case, the CW technique has been adapted to be conducted faster and more streamlined [8]. Researchers in software engineering and HCI report difficulties adopting usability evaluation techniques for development processes. In HCI, usability evaluations have been criticized for potentially 'muting creativity' and possibly harming the rapid prototyping processes in early stages of design because many evaluation methods cannot easily be adapted to unique development environments or cultural contexts [9]. *INspect-World* addresses these issues and implements additional features supporting distributed usability inspections.

Software development teams have seen the introduction of distributed work. Globally distributed software development teams have been studied widely, e.g. [10]. In our own work, we developed a system for cooperative sketching [11]. In a more recent study we investigated how individuals in distributed teams develop strategies to cope with the daily challenges of working remotely and alone [12]. We also conducted two empirical studies in a public game-oriented and an open-ended virtual world [13] and investigated how virtual worlds support elements of end-user development. We further explore these findings in the *INspect-World* system to provide a more productive and useful environment that focused on the users conducting the usability inspections.

Like many, we strongly believe in the potential of virtual environments [14], but we also believe it is important to answer prevalent criticisms. Through informal conversations with colleagues and peers we have compiled a set of concerns often expressed when virtual worlds are considered as serious work environments. Interviewees expressed concerns regarding the security of virtual world environments. Anonymous connections and imposters could disrupt serious work and access confidential information. Virtual worlds were also seen to pose potential distractions from serious work. The ability to freely move about the environment and to change the avatar's appearance could distract from the task at hand. A low adoption rate was also discussed, i.e. virtual worlds have not been widely adopted in industry and research because they are not appealing to broader user groups. The developed system *INspect-World* already addresses some of these concerns. Security is addressed by only allowing team members with valid accounts to enter the private collaboration environment. In-world functionality, such as modifications of the avatar and changes to the environment, can be limited for different user groups. The current prototype integrates a web portal that can be integrated with other collaboration and development tools in the organization. Through iterative development end empirical studies with users, our goal is to make *INspect-World* more and more suitable for serious collaboration work and lower the entry barrier. While using a virtual world interface is more costly than meeting face-to-face or using simple web conferencing tools, we believe that the added value of the virtual world outweighs this entry barrier hurdle.

IV. Discussion

INspect-World enables distributed usability inspections in dynamic and context-rich environments. Practitioners and usability experts can connect to the virtual environment and run through the evaluation process together. Compared to conducting similar inspection processes in co-located settings or in other common conferencing environments, *INspect-World* provides a set of advantages. **Shared points of reference and orientation** allow users to work collaboratively during the inspection process. Switching between inspected action screens only requires turning the

avatar. Other users get a sense of the reference change and can follow. Additionally, the **persistent 3D environment** provides the functionality to pause and resume usability inspection sessions at any point of time in *INspect-World*. The state of the environment is preserved exactly. By **recording usability inspections** in *INspect-World* sessions can be archived for later reviews or teaching purposes. This allows for a more in-depth analysis of how usability issues were discovered in the context of discussions or specific action sequences. An integrated solution for **data management and planning** allows participants to manage data related to the CW that is accessible in the virtual world, but also from other devices.

The iterative development of *INspect-World* allows us to explore aspects of end-user development that can be applied to the virtual environment. We aim at providing guidance for novice users to gradually become evaluation experts by using the environment, learning from co-workers and eventually changing the environment according to their specific needs. This scaffolding process has been expressed in the meta-design framework. The virtual world platform allows us to create a flexible and open environment for design tasks that are open to end-user modifications. For instance, the evaluation arena can be customized and re-arranged based on the type of evaluation and the participating users.

Learnability also represents an important aspect of our work. *INspect-World* allows for novel ways to educate software engineering concepts to professionals and students. Tutorials can be implemented in the virtual worlds and explored in distributed settings.

V. Evaluation

Although the work is at an early state we have conducted a preliminary evaluation. We conducted a CW using *INspect-World* with a group of graduate students. Users easily understood the overall concept and quickly oriented themselves in the virtual world. Moving between the action screens and interacting with other participants occurred relatively natural.

We learned that for future development iterations that the process of note-taking can be further improved. Visually separating the answers to the questions asked during the action sequences and providing a clearer indication of the progress during the walkthrough was mentioned as an area of improvement. Furthermore, users were suggesting a simulation of the use context (i.e. of a mobile phone user in an office setting) in addition to the walkthrough arena to better facilitate the 3D environment and to provide more references for the CW process. We are currently investigating this suggestion using a two-monitor setup.

VI. Conclusion

Conducting usability evaluations in globally distributed software development teams is becoming increasingly difficult. We developed a prototypical virtual environment called *INspect-World* to address this issue. While enabling novel ways to conduct distributed usability evaluations and teaching software engineering concepts in a virtual world, future development iterations will also allow us to explore end-user development aspects and human-centered design principles in mediated spaces. Collaborations on a global scale in virtual and computer-mediated spaces will continue to gain importance. We see our work to contribute important insights into future developments for the field of software engineering.

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